# House as a System

# Weatherization Energy Auditor Single Family

Learning Objectives

By attending this session, participants will be able to:

* Recognize the potential for interaction among building components and mechanical systems.
* Explain how air sealing a home can negatively affect indoor air quality.
* Recognize typical air leakage sites and know how to deal with them.

Key Terminology

Aldehydes

Backdraft

Bypass

Carbon monoxide (CO)

Chimney chase

Dropped soffit

Indoor air quality (IAQ)

Spauling

Stack effect

Vapor retarder

Supplemental Materials

Handouts & Resources

Cox, Anthony, and Melissa Byrd. “House of Pressure – A Model of Energy Efficiency.” *Home Energy* Mar./Apr. 2010: 26-28. <www.homeenergy.org>.

Fisette, Paul. “Q&A: Causes of Attic Mold.” Journal of Light Construction Nov. 2004. <www.jlconline.com>.

House as a System Quiz.

House as a System Quiz Answer Key.

Lstiburek, Joseph, and John Carmody. “Fundamentals of Moisture in Houses.” *Home Energy* Nov./Dec. 1995. <www.homeenergy.org>.

McWilliams, Jennifer A., and Iain S. Walker. “Retrofitting Residential HVAC Systems.” *Home Energy* Jan./Feb. 2005. <www.homeenergy.org>.

Partnership for Advancing Technology in Housing (PATH). *Your House is a System: Tips for the Handy Homeowner* Jan. 2006. <www.pathnet.org>.

Van der Meer, Bill. “Avoiding Moisture Problems.” *The Weatherization Training Center Technical Update* *1*. Weatherization Training Center at Pennsylvania College of Technology. Feb. 2003. <www.pct.edu>.

**Online Platform Lessons**

Use these online interactive training modules as prerequisites before students attend the course, or as in-class computer lab sessions. Users must first create an account at [www.nterlearning.org](http://www.nterlearning.org) to access the lesson.

i- 3.2 Moisture <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 3.4 Building Envelope, Thermal Envelope, Pressure Boundary & Conditioned Sapce  
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 3.5 House as a System – Part 1 <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 3.5 House as a System – Part 2 <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 6.3 Air Sealing for Separation: Garage, Porches and Between Occupancies  
<https://www.nterlearning.org/web/guest/course-details?cid=249>

Classroom Props & Activities

**House of Pressure**: A house of pressure is a transparent scale model of a house with active mechanical systems that can replicate a number of interactions that may occur between mechanical systems and the building shell in real houses. There are several models on the market and have proven themselves as very effective training tools for those who familiarize themselves with their many features. This learning tool can illustrate the interrelationships of home mechanical systems, air-tightness, and connectivity to the basement or garage as they relate to energy efficiency and IAQ issues. Plan intervals where a demonstration can serve to break up the monotony of the lecture and help drive home an important concept. Conduct a few demos like stack effect and mechanical effect to reinforce principle covered in the presentation. It’s best if you develop a written script, which contains all of the scenarios you want to demonstrate. A script will instruct the user exactly how to configure the model to produce the same results for each class. Encourage students to gather close to the model instead of watching from a distance.

**Class Overview**

* Use the presentation and class discussion to teach students that each house is a system of interrelated components.
* Have students discuss the problems that can arise if:
  + A home with no exhaust fans or with kerosene space heaters is air sealed (moisture issues).
  + An older furnace is replaced with a 90+ direct vent appliance, orphaning the water heater (backdrafting).
* Introduce the concept of mounting savings which result from effective energy efficient retrofits. Before providing the answers listed below, give students the opportunity to respond and write replies on the board or flip chart.
  + Air sealing and insulating reduce load on heating and cooling appliances, making it possible to downsize equipment. Smaller equipment costs less to purchase and operate.
  + Sealing ducts get conditioned air where it belongs, reducing the need for extra space heaters in rooms far from the heating source.
  + Air sealing and insulating the attic prevent warm, moist air from escaping, reducing residents’ heating bills, and preventing ice dams and the costly repairs associated with them.